Date of Issue:
12 August 2014

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 3154
SRM Name: Sulfur (S) Standard Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of sulfur. A unit of SRM 3154 consists of five 10 mL sealed borosilicate glass ampoules of a solution containing a known mass fraction of sulfur and a sulfuric acid volume fraction of approximately 0.1 %.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200
FAX: 301-948-3730
E-mail: SRMMSDS@nist.gov
Website: http://www.nist.gov/srm

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

Physical Hazard: Not classified.
Health Hazard: Not classified.

Label Elements
Symbol
No symbol/No pictogram.

Signal Word
No signal word.

Hazard Statement(s): Not applicable.

Precautionary Statement(s): Not applicable.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Sulfuric acid solution

Other Designations: Dihydrogen sulfate; battery acid; dipping acid; dithionic acid; sulphuric acid; nordhadsen acid

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Sulfuric acid	7664-93-9	231-639-5	0.1
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>99

4. First Aid Measures

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Not expected to be irritating to the skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. Fire Fighting Measures

Fire and Explosion Hazards: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Use extinguishing media appropriate to the surrounding fire.
Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition will form oxides sulfur.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 0 Fire = 0 Reactivity = 2

6. Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry. Keep out of water supplies.

7. Handling and Storage

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (see Section 10, "Stability and Reactivity").

8. Exposure Controls and Personal Protection

Exposure Limits

Sulfuric acid

NIOSH (REL): 1 mg/m^3 TWA
15 mg/m^3 IDLH

ACGIH (TLV): 0.2 mg/m^3 (thoracic fraction)

OSHA (PEL): 1 mg/m^3 TWA

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for sulfuric acid.

Descriptive Properties	**Sulfuric acid (0.1 % of this SRM)**
Appearance (physical state, color, etc.)	colorless to brown liquid
Molecular Formula	H_2SO_4
Molar Mass (g/mol)	98.07
Odor	odorless
Odor threshold	>1 mg/m^3 (mist)
pH	1.01[(a)]
Evaporation rate	not available
Melting point/freezing point	10 ºC (50 ºF)
Relative Density as specific gravity (water = 1)	1.84
Vapor Pressure	<0.001 at 20 ºC
Vapor Density (air = 1)	3.4
Viscosity (cP)	not available
Solubility(ies)	miscible with water
Partition coefficient (n-octanol/water)	not available
Thermal Stability Properties	
Autoignition Temperature	not available
Thermal Decomposition	not available
Initial boiling point and boiling range	330 ºC (626 ºF)
Explosive Limits, LEL (Volume %)	not applicable
Explosive Limits, UEL (Volume %)	not applicable
Flash Point	not applicable
Flammability (solid, gas)	not applicable

[(a)] pH tested at NIST to determine health and safety hazards. Value is not certified.

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Contact with combustible or incompatible materials. Keep out of water supplies and sewers.

Incompatible Materials: Combustible materials, halo carbons, oxidizing materials, amines, bases, halogens, metal carbide, acids, metals, metal salts, peroxides, reducing agents.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce oxides of nitrogen and sulfur.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Not expected to be irritating to the skin, eyes, and lungs.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Inhalation of concentrated sulfuric acid mist may cause inflammation of the upper respiratory tract, chronic bronchitis and etching of the dental enamel. Low concentrations, 0.35 mg/m^3 to 5 mg/m^3, may cause increased pulmonary air flow resistance and subsequent shallower and more rapid breathing.

Skin Contact: Repeated contact with low concentrations of sulfuric acid may cause skin desiccation and ulceration of the hands, and panaris or chronic purulent inflammation around the nails. Repeated contact with dilute solutions may cause dermatitis.

Eye Contact: Contact with diluted sulfuric acid may produce more transient effects from which recovery may be completes. Severity of the damage depends on the concentration and duration of exposure.

Ingestion: Ingestion of this material is unlikely under normal conditions of use. If ingested, concentrated sulfuric acid can cause severe burns and damage to the gastrointestinal tract.

Numerical Measures of Toxicity

Acute Toxicity: Not classified.
Sulfur acid: Rat, Inhalation LC_{50}: 510 mg/m^3 (2 h); 510 mg/m^3
Rat, Oral LD_{50}: 2140 mg/kg

Skin Corrosion/Irritation: Not classified; this SRM contains <5 % of sulfuric acid.
Sulfuric acid is irritating and corrosive to the skin at higher concentrations.

Serious Eye damage/Eye Irritation: Not classified; this SRM contains <5 % of sulfuric acid.
Sulfuric acid is irritating and corrosive to the eyes at higher concentrations.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen _____ Yes X No
Occupational exposure strong to inorganic acid mists containing sulfuric acid are listed by IARC as Group 1 (*carcinogenic to humans*) and NTP as known to be human carcinogens. Sulfuric acid is not listed by OSHA as a carcinogen/potential carcinogen.

Reproductive Toxicity: Not classified.
Sulfur acid, Rabbit, Inhalation TCLo: 20 mg/m^3 (7 h, pregnant 6 d to 18 d)

Specific Target Organ Toxicity, Single Exposure: No data available.

Specific Target Organ Toxicity, Repeated Exposure: No data available.

Aspiration Hazard: Not applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: Sulfuric acid, Fish: Zebrafish (*Brachydanio rerio*) LC50 (static): >500 mg/L (96 h)

Persistence and Degradability: No data available.

Bioaccumulative Potential: No bioaccumulation expected.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Sulfuric acid subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D002, and D003.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: This material is not regulated by DOT or IATA.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4):	Sulfuric acid, 1000 lbs. (454 kg) final RQ
SARA Title III Section 302 (40 CFR 355.30):	Sulfuric acid, 1000 lbs. (454 kg) TPQ
SARA Title III Section 304 (40 CFR 355.40):	Sulfuric acid, 1000 lbs. (454 kg) EPCRA RQ
SARA Title III Section 313 (40 CFR 372.65):	Sulfuric acid, 1 % de minimis concentration (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)
OSHA Process Safety (29 CFR 1910.119):	Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	No
CHRONIC HEALTH:	No
FIRE:	No
REACTIVE:	No
PRESSURE:	No

State Regulations: Not listed under California Proposition 65.

U.S. TSCA Inventory: Sulfuric acid is listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations: WHMIS Information is not provided for this material.

16. OTHER INFORMATION

Issue Date: 12 August 2014

Sources: ChemAdvisor, Inc., SDS *Sulfuric Acid*, 21 March 2014.

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Sulfuric Acid CAS No. 7664-93-9* ; available at http://toxnet.nlm.nih.gov (accessed Aug 2014).

NTP; Report on Carcinogens, Twelfth Edition (2011), *Strong Inorganic Acid Mists Containing Sulfuric Acid CAS No. 7664-93-9*; available at http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/stronginorganicacidmists.pdf (accessed Aug 2014).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLm	Threshold Limit, median
MSDS	Material Safety Data Sheet	TLV	Threshold Limit Value
NFPA	National Fire Protection Association	TPQ	Threshold Planning Quantity
NIOSH	National Institute for Occupational Safety and Health	TSCA	Toxic Substances Control Act
NIST	National Institute of Standards and Technology	TWA	Time Weighted Average
n.o.s.	Not Otherwise Specified	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at http://www.nist.gov/srm.